



**Gold King Mine Acid Mine Drainage Release –
Analysis of Fate and Transport of Metals in the
Animas and San Juan Rivers**

Water Quality Since the Release Event

August 2015 to November 2016

Gold King Team
National Exposure Research Lab/ORD
November 28 2016



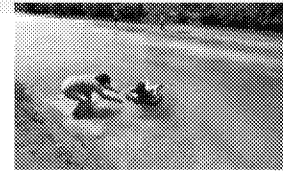
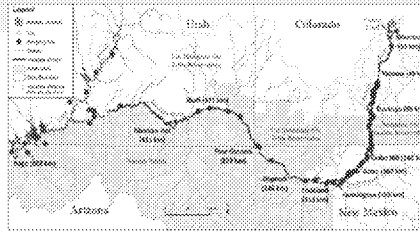
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Fate of the Gold King Mine released metals

- Approximately 500,000 kg delivered from mine to Animas River at Silverton
 - 1% from within mine
 - 99% from waste pile outside
- 90% of mass deposited in the Animas River
(most between Silverton and Durango CO)
- 5% deposited in the San Juan River
(distributed over 250 km)
- 5% to Lake Powell



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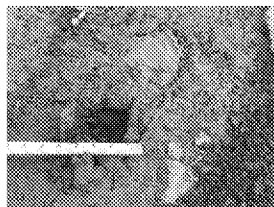
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CURRENT QUESTIONS:

- ◊ What were the Gold King effects on water quality after the event?
- ◊ Has water quality returned to pre-event conditions?
- ◊ Was there be a second wave of contamination during 2016 snowmelt when high flows could mobilize deposits?
- ◊ Can we recognize the Gold King influence given the pre-existing contamination from historic mining?

What Was Left Behind

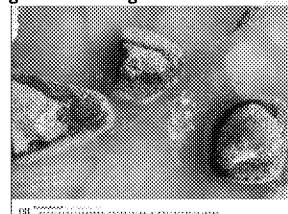
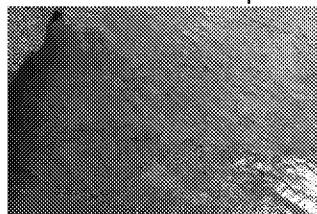
Sludge-like material



Colloids (Paint-like)



Deposits along channel margins



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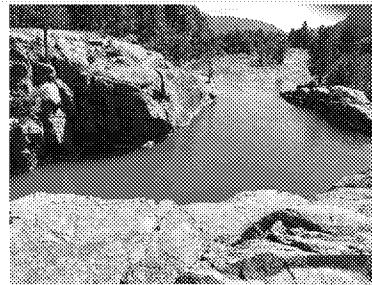
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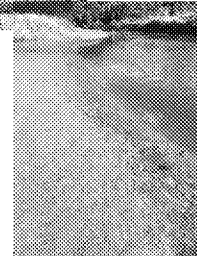
Key Findings—Gold King Release Post Event

- **ORD produced hydrologic and geochemical evaluations of the Gold King release during and for a year following the release**
- **Post event water quality response from August to October 2015 varied by location**
 - Animas in Colorado returned to background
 - Animas in New Mexico and San Juan River had elevated metals above expected
 - Chronic exceedances of water quality criteria revealed by monitoring
- **2016 snowmelt had elevated metals throughout the system—partly from Gold King, partly from historic mining impacts**
 - Model results and analyses indicate GKM metals now out of rivers
 - 2016 samples after snowmelt at pre-event levels
 - We have a “fingerprint” unique to identify metals of the Gold King release
- **There were water quality exceedances during the plume and post event varying by location and state or tribe, some due to Gold King**
 - E.g. aluminum, lead, copper, zinc, arsenic
- **ORD findings will help inform EPA monitoring and reporting**



Animas at Bakers Bridge (above) and popular swimming beach north of Durango (right)

August 2016

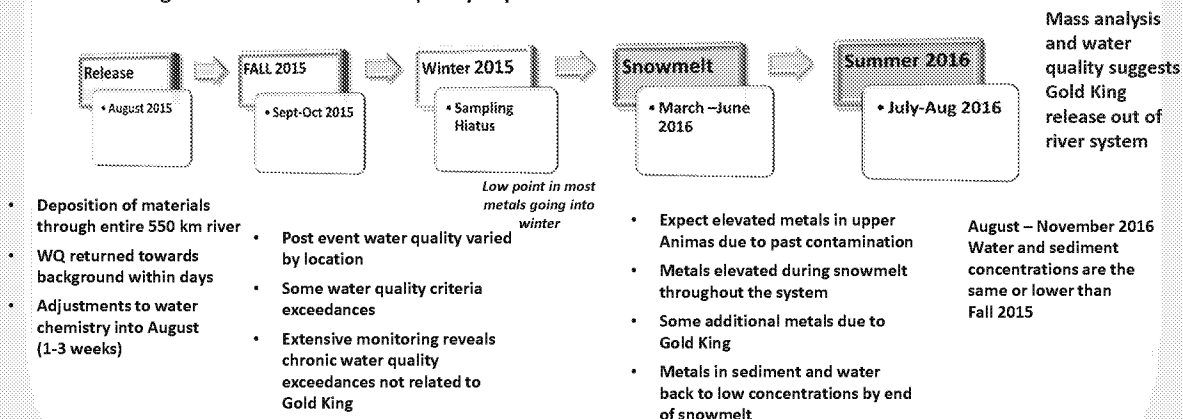


Both areas experienced high settling rates during plume

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Gold King release effects on water quality depended on where and when



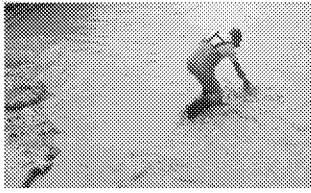
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Water and Sediments Monitored Since the Release



POST GOLD KING MONITORING

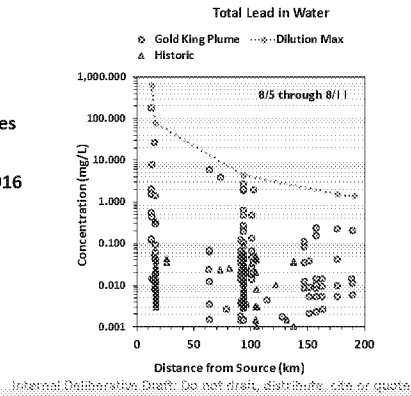
- 1,400 total and dissolved water samples through 8/27/2016
- 820 sediment samples through 9/1/2016
- 294 sites with 1 or more samples

HISTORIC DATA

- Hundreds of water samples
- 30-50 sediment samples

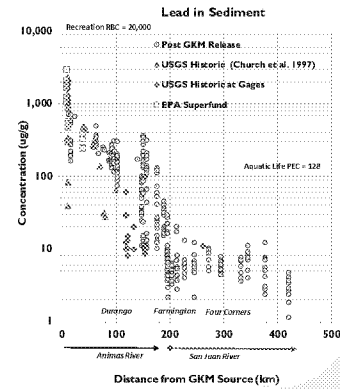
WATER:

--Concentrations decreased in water and sediment moving down river from the Gold King during plume



Sediment:

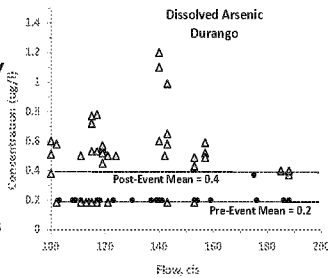
- Deposited metals reflect historic contamination
- No statistical change from historic



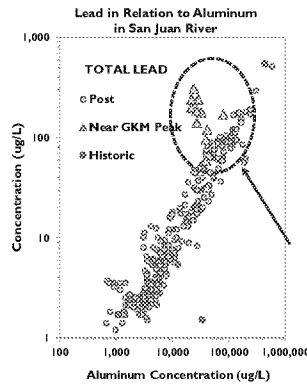
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Statistical comparisons between pre- and post-event samples

- * Limited to locations where pre-event data existed
- * Comparisons with pre-event limited by available historic data
- * Significantly reduced number of post-event monitoring samples that could be used



Correlation analysis between trace metals and aluminum or iron



- * Relationship between trace metals and Aluminum or Iron is an indicator of expected background levels in sediments and water
- * Used in project as a sensitive signature of the of Gold King metals
- * Maximizes use of available data
- * Even a limited amount of historic data is useful

Lead high for amount of background aluminum as Gold King plume passed through

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Metals Concentration Trajectories Depended on Location

Animas River in Colorado (RK 0 to 150):

- returned to pre-event levels in the weeks after the release
- stayed there through the winter

Immediate: Aug 5 to Aug 19
Later : after Aug 19

Aluminum and Iron oxides were a major component of deposited precipitates

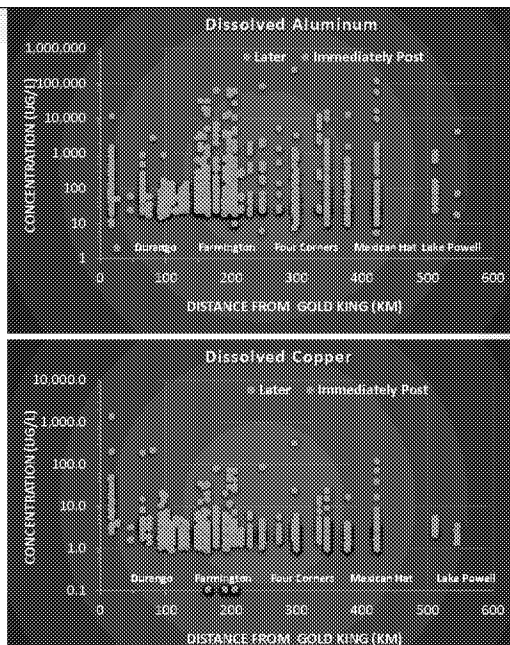
Animas River in New Mexico (RK 150 to 192):

- Initially returned to low levels
- Most dissolved metals increased after Aug 27 storm

San Juan River (Rk 193 to 540)

- Increased Aluminum and Iron in Animas carried into San Juan

Gold King deposits influenced water chemistry over an extended period

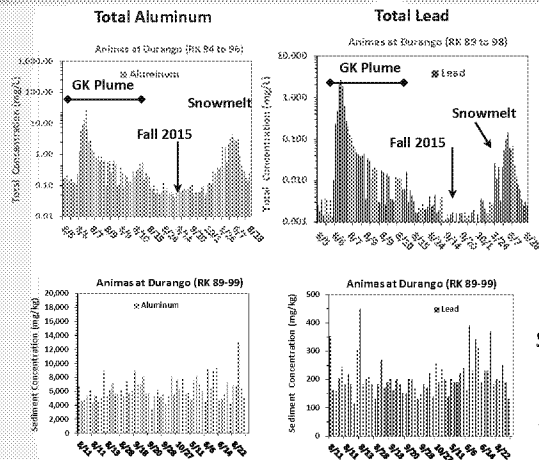


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Middle Animas -- Colorado Post Event



Animas at Durango CO

WATER

- Water concentrations receded over 2 – 3 week period after the plume
- Trace metals very low during Fall 2015 (lower than historic)
- Metals increased and declined with flow during snowmelt
- Concentrations back to low levels in August 2016

SEDIMENT

Event to August 2016

- Background sediment metals are high due primarily to legacy mining
- Sediment metals concentrations variable but relatively unchanged during Fall months and snowmelt
- Aluminum in the recent deposits “active”

Plots include every sample within 10 km of Animas in the city of Durango plotted sequentially in time—PLOTS COMPRESS TIME

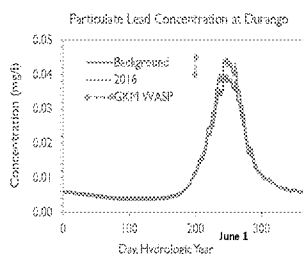
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* We expected increased metals concentrations during snowmelt based on historic observations

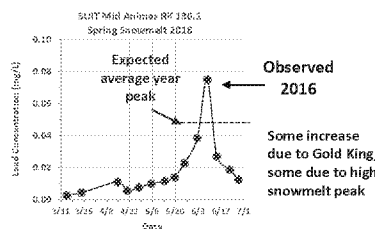
- Concentration increase was not large
- Volume of water carries a lot of mass

* Metals concentrations appeared to increase a small amount early in snowmelt due to Gold King relative to expected

* Concentrations returned to low levels by end of snowmelt

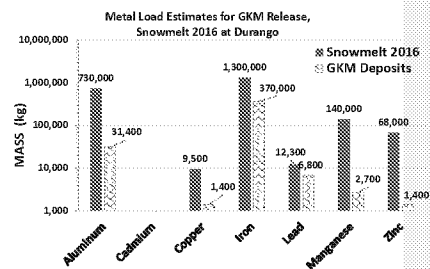


Predicted concentration based on historic data



Some increase due to Gold King, some due to high snowmelt peak

Total metal mass transported through 2 months of snowmelt



More than enough to account for all of Gold King deposited mass

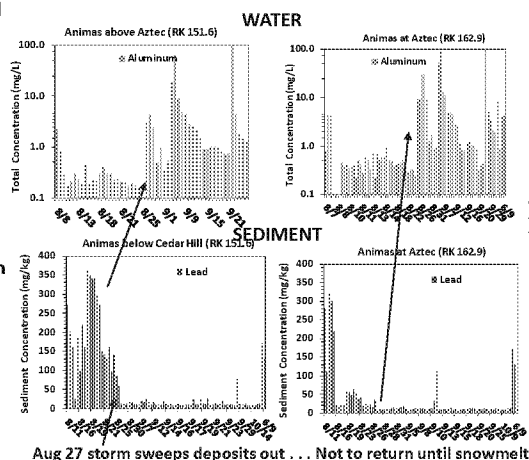
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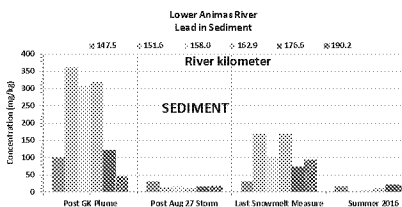
Lower Animas Post Event Animas between Durango and Farmington NM RK 132-190

Every observation at two locations over time

- Lead (and other metals) accumulated in sediment in lower Animas during and after Gold King plume
- Large storm 3 weeks after release cleans deposits from river
- Metals in water then increased
- Carried into San Juan
- Important for water quality
- Snowmelt concentrations increased—does this happen every year?



Summary at 6 locations in lower Animas at key times during year

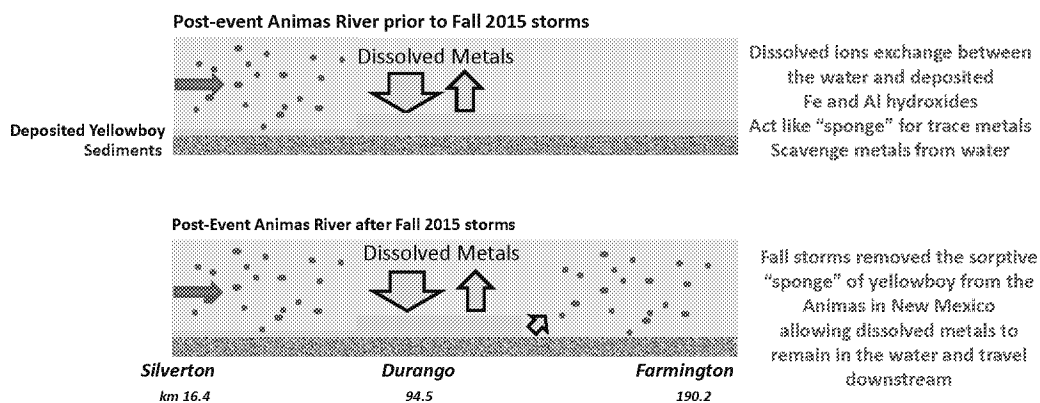


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Theory for why metals increased in the lower Animas River during the Fall after the Gold King Release



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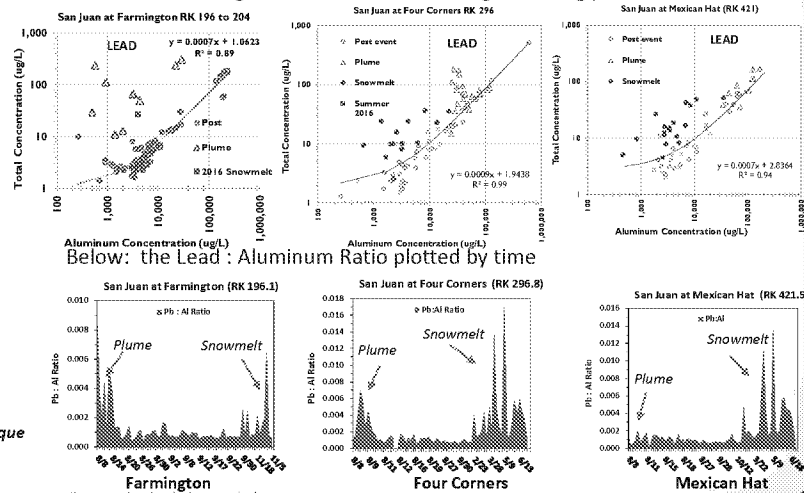
San Juan Post Event Water/Sediment

Concentrations of metals (lead) in San Juan River

- Influenced by Animas near confluence in Farmington
- Were elevated during plume--undetectable at lower reaches near Mexican Hat
- Also elevated in water and sediment during snowmelt season
- Lead main metal detected

This correlation technique was powerful for identifying Gold King

Water Concentration--higher lead detectable during Gold King plume and snowmelt



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Has the System Returned to Pre-Event?

What Did Statistics Confirm About Post-Event Metals—Fall 2015?

Water

- Most metals significantly lower after Gold King in the middle Animas (Colorado)
- Elevated Iron and Aluminum in lower Animas after August storms (New Mexico)
- Elevated Iron and Aluminum in San Juan throughout the period (NM, UT, Navajo)

Sediment

- Despite large deposited mass, no significant increase in river sediments

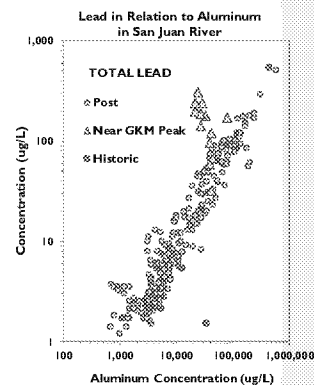
What Remains to be Established?

Water

- We saw a Gold King signature far down the San Juan during snowmelt (RK 350km – Montezuma Creek). Will that reoccur in later years?
- Can we reliably establish baseline relationships between Aluminum and other metals as evidence to confirm the end of GKM influence in the system?

Sediment

- We expect to see higher sediment mass moved during snowmelt every year in Colorado. Will we also see elevated metals during snowmelt in lower Animas and San Juan in 2016?



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Are Changes to Water Quality Meaningful?

* EPA Conceptual Monitoring Plan Implemented 2016

- Proposes to answer this question by comparing observed concentrations to water quality criteria
- To assist OW in doing this for 1st year monitoring results, we have done this screening

24 metals x 40 criteria : 1400+ samples

* About the Criteria

- Multiple states and tribes located at different points along the river
- Criteria address both total and dissolved fractions
- Cover a wide range of concentrations depending on beneficial use
- Many tribal criteria thresholds much lower than states

		Total										Dissolved									
		mg/L																			
Surface Water Quality Screening Criteria		Aluminum	Antimony	Barium	Bismuth	Boron	Cadmium	Chromium	Copper	Cyanide	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Nitrate	Nitrite	Selenium	Silver	Sulfate
Domestic Water Supply	Aluminum	0.050	0.005	0.010	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Antimony	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Barium	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Bismuth	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Protection and Enhancement of Sensitive	Aluminum	0.050	0.005	0.010	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Antimony	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Barium	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Bismuth	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Aquatic Life	Aluminum	0.050	0.005	0.010	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Antimony	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Barium	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Bismuth	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Fish and Wildlife	Aluminum	0.050	0.005	0.010	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Antimony	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Barium	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Bismuth	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Sensitive	Aluminum	0.050	0.005	0.010	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Antimony	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Barium	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Bismuth	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

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WQ Exceedances During the Interval From August 2015 to August 2016

Count of exceedances: yellow in box indicates at least 1

There were water quality exceedances during the Gold King plume

There have been exceedances post-event

Some chronic, some storm event related

Number of Exceedances Observed in Monitoring Data

Colorado

ANIMAS RIVER

n= 371

	Aluminum	Lead	Arsenic	Copper	Zinc	Cadmium
Domestic Supply 1-Day	0	42	0	0	0	0
Agriculture	0	23	5	9	2	2
Aquatic Acute	9	0	0	5	15	1
Aquatic Chronic	26	4	0	11	25	10

Number of Exceedances Observed in Monitoring Data

New Mexico

ANIMAS RIVER

n= 416

	Aluminum	Lead	Arsenic	Copper	Zinc	Cadmium
Domestic Supply	0	6	2	0	0	0
Irrigation	0	0	0	0	0	0
Livestock	0	0	0	0	0	0
Wildlife Habitat	0	0	0	0	0	0
Aquatic Acute	17	0	0	4	0	0
Aquatic Chronic	10	13	0	7	1	2

Number of Exceedances Observed in Monitoring Data

UTAH

SAN JUAN RIVER

n= 300

	Aluminum	Lead	Arsenic	Copper	Zinc	Cadmium
Domestic Source	5	2	0	0	0	0
Recreational	0	0	0	0	0	0
Irrigation (short-term)	4	0	0	0	0	0
Irrigation (long-term)	13	0	0	1	0	0
Agricultural Uses	0	0	1	0	0	0
Livestock	13	0	0	0	0	0
Warm Water Fish 1-hr	10	0	0	3	2	0
Warm Water Fish 4-day	13	0	7	2	6	0

Preliminary

Number of Exceedances Observed in Monitoring Data

New Mexico

SAN JUAN RIVER

n= 223

	Aluminum	Lead	Arsenic	Copper	Zinc	Cadmium
Domestic Supply	7	1	0	0	0	0
Irrigation	7	0	0	0	0	0
Livestock	0	0	0	0	0	0
Wildlife Habitat	0	0	0	0	0	0
Aquatic Acute	14	0	0	7	0	0
Aquatic Chronic	113	5	0	7	1	5

10/16/2016 10:11:11 AM WQ Exceedances - Final for quote



WQ Exceedances San Juan River San Juan River – Navajo Nation, Ute Mtn Ute

- Tribal criteria establish significantly lower thresholds for many criteria

- Exceeded frequently

- Many exceedances can be explained by natural sediment loads

Number of Exceedances Observed in Monitoring Data
NAVAJO NATION SAN JUAN RIVER

	n = 589					
	Aluminum	Lead	Arsenic	Copper	Zinc	Cadmium
Domestic Water Supply	0	263	834	0	0	14
Primary Human Contact	0	263	26	0	0	0
Secondary Human Contact	0	263	0	0	0	0
Agricultural Supply	37	0	0	0	0	0
Livestock Watering	0	55	0	0	0	0
Acute Ag and Wildlife	532	1	0	0	6	5
Chronic Ag and Wildlife	589	22	0	0	9	180

Challenge for Office of Water

- How to interpret monitoring data for "importance" of Gold King

Number of Exceedances Observed in Monitoring Data

UTE MOUNTAIN UTE SAN JUAN RIVER

	Preliminary n = 209					
	Aluminum	Lead	Arsenic	Copper	Zinc	Cadmium
Drinking Water	205	50	209	0	0	0
Ceremonial, other uses	0	50	209	0	0	0
Fish consumption	0	0	209	0	0	0
Agriculture	0	20	0	3	0	0
Acute Warm Water	194	203	0	13	205	0
Chronic Warm Water	0	203	0	209	205	191

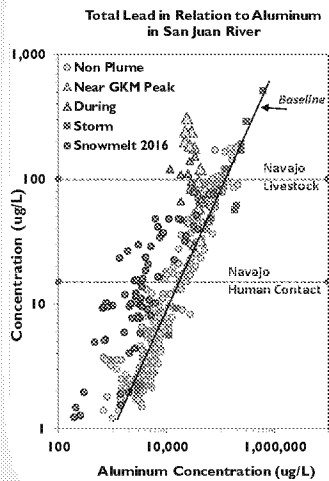
Challenge for ORD

- Can we identify which of these exceedances belong to Gold King?

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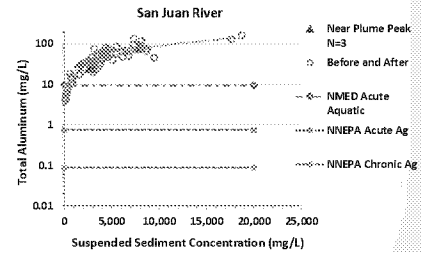
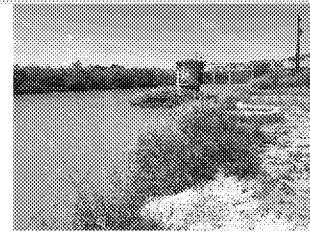
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Correlation technique can help with sorting Gold King effects from natural background metals and pre-existing contaminated conditions

Natural sediment loads in the San Juan ensure that aluminum will almost always exceed some of the New Mexico, Utah and Navajo criteria

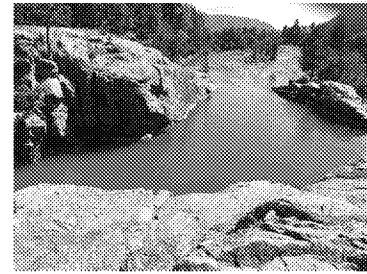


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Key Findings—Gold King Release Post Event

- * **ORD produced hydrologic and geochemical evaluations of the Gold King release during and for a year following the release**
- * **Post event water quality response from August to October 2015 varied by location**
 - Animas in Colorado returned to background
 - Animas in New Mexico and San Juan River had elevated metals above expected
 - Chronic exceedances of water quality criteria revealed by monitoring
- * **2016 snowmelt had elevated metals throughout the system—partly from Gold King, partly from historic mining impacts**
 - Model results and analyses indicate GKM metals now out of rivers
 - 2016 samples after snowmelt at pre-event levels
 - We have a “fingerprint” unique to identify metals of the Gold King release
- * **There were water quality exceedances during the plume and post event varying by location and state or tribe, some due to Gold King**
 - E.g. aluminum, lead, copper, zinc, arsenic



Next Steps:

- Finalizing ORD Report
- Working with OWOW to have ORD report support EPA obligations for a 1st year monitoring report
- Evaluating monitoring needs going forward
- Publish findings



Project Team

ORD/NERL

- Kate Sullivan, Hydrology, project lead
- Chris Knightes, WASP lead, water quality
- Mike Cyterski, Data analysis, statistics
- John Washington, Geochemistry
- Steve Kraemer, Groundwater
- Craig Barber, Fish effects
- Anne Neale, Megan Mehaffey, EnviroAtlas
- Lourdes Prieto, Data acquisition and GIS
- Elena Horvath & Megan Culler (EPA Student Services Contractors);
- Brian Avants; Mike Mangiante (EPA ORISE Fellows)

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Compiled State and Tribal Water Criteria

Water Quality Criteria

- Use both dissolved and total fractions
- A lot of variation for the same metal depending on use and entity
- States generally similar
- Tribal criteria tend to be lower

Surface Water Quality Screening Criteria																			Total		Dissolved	
Screening Criteria	Abatement	Antimony	Asbestos	Cadmium	Cobalt	Copper	Chromium	Lead	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Phosphorus	Selenium	Silver	Sulfur	Thallium	Vanadium	Zinc	
Domestic Water Supply	Domestic Supply	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Domestic Water Supply	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Domestic Water Supply	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Domestic Supply - Day	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Domestic Supply - Night	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
Recreation and Human Contact	Recreation - Swimming	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Recreation - Other Uses	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Recreation - Other Uses	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Recreation - Other Uses	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Recreation - Other Uses	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
Agriculture	Agriculture - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Agriculture - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Agriculture - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Agriculture - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Agriculture - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
Livestock	Livestock - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Livestock - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Livestock - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Livestock - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Livestock - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
Aquatic Life	Aquatic Life - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Aquatic Life - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Aquatic Life - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Aquatic Life - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	
	Aquatic Life - Irrigation	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	0.0500	

We screened post release data against all criteria

Some require water hardness measure

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